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Risk Assessment Work Plan
Preliminary Study Area
Boise, Idaho

Prepared for

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This document was prepared for the sole use of Van Waters & Rogers Inc. in meeting the requirements of the Preliminary Study Area Consent Order as required by the Idaho Department of Health and Welfare, Division of Environmental Quality. No other party should rely on the information without prior written consent of HLA and Van Waters & Rogers Inc.

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ABBREVIATIONS

AL	Action Level
AST	above ground storage tank
atm-m^3/mol	Atmosphere-cubic meter per mole
bgs	below ground surface
cis-DCE	cis-1,2-Dichloroethene
CL	Cleanup Level
COPC	Chemical of Potential Concern
DCE	Dichloroethene
1,2-DCE	1,2-Dichloroethene (total, *cis* or *trans*)
DNAPLs	Dense Non-Aqueous Phase Liquids
EPA	Environmental Protection Agency
FOD	Frequency of Detection
HLA	Harding Lawson Associates
HQ	Hazard Quotient
IDHW	Idaho Department of Health and Welfare
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
µg/l	micrograms per liter
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
MPS	Media Protection Standard
MW	Monitoring Well
PCE	Perchloroethylene (tetrachloroethene)
PRGs	Preliminary Remediation Goals
PSA	Preliminary Study Area
RA	Risk Assessment
RAP	Remedial Action Plan
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
SF	Slope Factor
SQL	Sample Quantitation Limit
SVE	Soil Vapor Extraction
1,1,1-TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
trans-DCE	trans-1,2-Dichloroethene
UCL	Upper Confidence Limit
VC	Vinyl Chloride
VOC	Volatile Organic Compound
VW&R	Van Waters & Rogers Inc.

1.0 INTRODUCTION

Harding Lawson Associates (HLA) has prepared this risk assessment (RA) Work Plan for Van Waters & Rogers Inc. (VW&R), Kirkland, Washington, for the Preliminary Study Area (PSA), Boise, Idaho (Plate 1). The original scope of work for the RA was presented in *Exhibit #1, Work Plan, Preliminary Study Area Investigation, Boise, Idaho*, dated September 8, 1992 (*HLA, 1992a*). This Work Plan has been prepared to fulfill a condition of the Consent Order dated October 9, 1992 (PSA Order), between VW&R and the State of Idaho Department of Health and Welfare (IDHW), Division of Environmental Quality (Department; *IDHW, 1992a*).

The Work Plan describes the approach for conducting the PSA RA. The objective of the RA is to evaluate potential threats to human health and the environment from exposure to chemicals detected in groundwater and surface water in the PSA. The RA will also identify preliminary remediation goals (PRGs) to be included in the PSA Remedial Action Plan (RAP). The RAP will describe corrective measures, if any, to be implemented in the PSA to protect human health and the environment.

The PSA is an area to the northwest (i.e., downgradient) of the Boise Towne Square Mall (Mall). This Work Plan divides the vicinity of the Mall and PSA into four areas based on proximity to a potential source of contamination (e.g., soil), interim remedial measures performed and in operation, current and future land uses, and the chemical concentrations in groundwater (Plate 2). The criteria used to delineate Areas 1, 2, 3, and 4 are further discussed in Section 2.1.

The Mall is identified as Area 1 and is being evaluated independently (including an RA) as a condition of a separate Consent Order between VW&R and the Department (Boise Mall Order). A final Mall RA Work Plan was prepared and approved by the Department (*HLA, 1993b*), and the Mall RA is underway.

The PSA RA will evaluate the other three areas. The Mall RA results as they pertain to the PSA will be summarized in the PSA RA; therefore, data available for the Mall are also discussed in this Work Plan for completeness. Areas 2 (Westpark Area) and 3 comprise the portion of the PSA where tetrachloroethene (PCE) concentrations in groundwater exceed the maximum contaminant level (MCL) of 5 micrograms per liter (μg/l; referred to as the Affected Area). Area 4 is the area adjacent to the Affected Area. Possible health risks will be evaluated separately for each of the areas to facilitate making risk management decisions for the PSA and the Mall.

Table 1 presents a conceptual model identifying possible complete exposure pathways and summarizing possibly affected media (e.g, soil), potential chemical release mechanisms (e.g., volatilization), and chemical sources (e.g., groundwater plume) related to Areas 1, 2, 3, and 4 (Section 5.0). The RA for the Mall will address exposure pathways associated with possible ingestion of and direct contact with soil, and inhalation of vapors from soil and groundwater which might diffuse into indoor and outdoor air. The PSA RA will address possible exposure pathways associated with groundwater and surface water for both human and possible ecological receptors. The rationale for addressing these exposure pathways is presented in Table 1 and discussed further in the Mall RA Work Plan (*HLA, 1993b*) and this PSA Work Plan (Section 5.0).

The site description and history and data collected from the four areas are presented in Section 2.0. Sections 3.0 and 4.0 provide a preliminary exposure analysis. Section 5.0 presents the proposed scope of work to conduct the PSA RA based on the information presented in Sections 2.0 through 4.0. The schedule for completing the PSA RA is presented in Section 6.0, and references cited in this Work Plan are listed in Section 7.0.

2.0 BACKGROUND

2.1 Site Description and History

From approximately 1973 to 1983, VW&R operated a small chemical distribution facility in a portion of a warehouse on Friendly Drive, Boise, Idaho. Today, a Pier 1 Imports store at 140 Milwaukee Avenue occupies the general area of the former VW&R facility which is approximately 1,200 feet (ft) from the intersection of Cole and Franklin roads (Plate 3). A 6,000-gallon aboveground storage tank (AST; Plate 3) used to store PCE was located in an outdoor storage area at the eastern end of the former warehouse.

Beginning in approximately 1987, the area west and north of the former VW&R location was commercially developed. Projects include the Mall, a portion of a Westpark Shopping Center Associates (Westpark) development (property bounded by Emerald Street, Westpark Drive, Milwaukee Street, and Benjamin Lane and Emerald Street), a development by Walla Walla Shopping Center Associates, other retail stores, light commercial buildings, and high density housing.

Since 1987, several environmental investigations have been performed in the vicinity of the Mall. During development of the Westpark Center, PCE was detected in soil and groundwater samples. The PSA was identified for study by VW&R because PCE was detected in some private wells in that area. The PSA includes the theater property west of the 140 Milwaukee Avenue Area and the area northwest of the Mall property (Plate 2). The PSA is generally bordered by North Five Mile and Hampton roads to the west, Sunflower Lane to the northwest, and the area between Emerald Street and the Union Pacific Railroad to the south (Plate 1). A suspected source of PCE contamination in the PSA is the former AST at the former VW&R facility.

Summaries of field investigations and data collected by HLA and others between 1987 and early 1992 in the Mall and PSA are presented in *Exhibit #3, Work Plan, Boise Towne Square Mall Supplemental Investigation and Final Remediation*, dated September 8, 1992 (*HLA, 1992b*). Ongoing investigations and RAs are being conducted. In 1992, the Department issued a Project Fact Sheet (Appendix) on PCE (referred to as "Perc") to water users in the PSA stating, in part (*IDHW, 1992a, b*):

> The Department ... has identified ... perchloroethylene or Perc in private wells. ... Anyone living in the affected area -- and using water from a well -- will be offered a free hookup to Boise Water Corp.'s public water lines. ... It is safe to water your garden with water contaminated with Perc.
>
> However, because Perc evaporates and can be inhaled, watering should be done outdoors or in a well-ventilated space. Health officials advise against using water containing Perc (PCE) for any purpose indoors.
>
> Since 1990, a ground water treatment system has been operating in an area near the intersection of Benjamin Lane and Emerald Street. This system has already treated about 190 million gallons of ground water containing Perc. The state will be working to identify any additional sources and will work with all responsible parties to perform the necessary investigation and cleanup.

The sections that follow describe the Mall (Area 1) and the PSA (Areas 2, 3, and 4). The criteria used to identify Areas 1, 2, 3, and 4 and the available analytical data for each area to be used in preparation of the RAs are discussed below. Although the Mall RA is

being prepared separately, the Mall is discussed to present more current information than that presented in the Mall RA Work Plan.

2.1.1 Area 1: Mall

Area 1 consists of the Mall, the Mall parking lot, and other retail establishments associated with the Mall (Plates 2 and 3). The RA for the Mall is being completed separately as specified in the Boise Mall Order and as shown in Table 1, specifically addresses exposure pathways related to soil. The current and expected future land use and zoning for the Mall are commercial. Workers (construction, maintenance, and other Mall employees) and shoppers including children and adults are present at times in Area 1. Potential ecological receptors within this area, if any, will be identified in the Mall RA (*HLA, 1993*b).

Groundwater beneath the Mall is not currently used for residential, agricultural, or industrial purposes; water used at the Mall is supplied by Boise Water Corporation. Groundwater downgradient of the Mall is being addressed in the PSA RA as Areas 2, 3, and 4.

The former VW&R facility was located on the south edge of Area 1. Currently, VW&R is operating a soil vapor extraction (SVE) system in the vicinity of the former AST location (Plate 3).

2.1.2 Area 2: Westpark Area

Area 2 is a portion of the area directly west of the Mall property generally bounded by Westpark Drive to the south, the South Slough to the west, commercial property directly north of Emerald Road to the north, and the Mall property to the east. The current zoning for Area 2 is commercial. One parcel in Area 2 directly west of the Mall property is zoned as open space. Current and expected future land use in Area 2 is commercial. Workers (office, construction, and maintenance), shoppers and visitors (including adults and children) are present at times in Area 2. Potential ecological receptors, if any, will be identified in the PSA RA (Section 5.7; Task 7).

Two private wells are known to exist in Area 2. One is located in a business park and is used for irrigation purposes only; water uses from the other well will be identified during preparation of the RA. Drinking water is supplied to Area 2 by the Boise Water Corporation.

Westpark and the Department agreed in January 1989 to a Consent Order to address PCE detected in groundwater beneath the Westpark property. The Order incorporated a cleanup plan which proposed groundwater pumping and treatment using air stripping to a achieve cleanup level of 10 μg/l. Groundwater treatment has been underway since March 12, 1990. Treated groundwater is discharged to the South Slough irrigation collection/recharge system operated by the Nampa and Meridian Irrigation District (*SRM, 1988; 1989*). The location of the treatment system is shown on Plate 2.

2.1.3 Area 3: Downgradient of Westpark Area

Area 3 includes the Affected Area northwest (downgradient) of Area 2. Land uses in Area 3 are residential, agricultural, and commercial. Residents (including adults and children), farmers, and office/commercial workers are present in Area 3. Groundwater in this area is currently used primarily for agricultural and industrial purposes, with limited residential use.

2.1.4 Area 4: Outside the Affected Area

The wells outside the Affected Area (outside Areas 2 and 3), will be addressed as Area 4. Land uses in Area 4 are residential, agricultural, and commercial. Residents (including adults and children), farmers, and office/commercial workers are present in Area 4. Groundwater in this area is currently used primarily for agricultural and industrial purposes, with very limited residential use.

2.2 Chemical Characterization

This section summarizes the analytical data available and to be considered in evaluating

potential threats to human health and the environment associated with Areas 1, 2, 3, and 4. Information from the Mall RA Work Plan (*HLA, 1993b*) is updated and discussed as appropriate. As previously stated, even though the RA for Area 1 is being completed separately from the PSA, Area 1 is also discussed for completeness. Details of the site characterization and evaluations of the nature and extent of the chemicals in these areas are not presented here; documents containing this information are identified, as appropriate. Although chemical concentrations reported by other parties exist for each area, only the concentrations presented below are expected to be used in the RA. Data summaries presenting the number of detections, number of analyses, frequencies of detection, and minimum and maximum concentrations for each chemical analyzed are presented in Tables 2 through 8. The arithmetic mean of the concentrations and the 95 percent upper confidence limits (UCL) of the arithmetic mean are also presented for each chemical. Mean and UCL concentrations were computed using one-half the detection limit as the analyte concentration for samples in which the analyte was not detected. These data are further discussed below.

2.2.1 Area 1: Mall

Tables 2, 3, and 4 summarize the data currently available for soil, groundwater, and soil gas, respectively, for use in the Mall RA. These tables incorporate more recent analyses than those presented in the Mall RA Work Plan (*HLA, 1993b*, i.e., additional validated data collected subsequent to the Department's approval of the Mall RA Work Plan). The data available for the Mall are discussed below.

2.2.1.1 Soil

In November 1991, soil samples were collected from four soil borings at the Mall. The analytical results were presented in a report to the Department dated December 17, 1991 *(HLA, 1991b)*, and are summarized in Table 2.

2.2.1.2 Groundwater

In 1991, eight monitoring wells were installed at the Mall; two were installed and sampled for the Department (*Chen-Northern, 1991; Conde, 1991*) and six were installed and sampled by GZA for the Mall owners (*GZA, 1991*). In June 1992, the six GZA monitoring wells were sampled by Industrial Health Incorporated - Environmental (*IHI, 1992*). The results of the chemical analyses reported by GZA are considered unusable for RA purposes because nonstandard sampling and analysis procedures were used. Groundwater data generated by IHI and the State may be used in the Mall RA to increase the sample size of the VW&R/HLA dataset described below. Presently, Table 3 does not include GZA, IHI, or State data.

Groundwater data were collected by VW&R and HLA at the Mall during several investigations. In September 1991, HLA collected groundwater samples from two State of Idaho wells (State MW-1 and State MW-2) on the Mall property (*HLA, 1991a*). In February 1993, groundwater samples were collected from two GZA wells (GZ-4 and GZ-6), and the results are presented in the *Quarterly Progress Report, January-March 1993* (*HLA, 1993c*). In March and April 1993, two wells were installed at the Mall by HLA for VW&R (MW-1 and MW-2). Groundwater samples were collected from the borings for the wells as the boreholes were drilled and from the completed monitoring wells. Analytical results are presented in the *Pilot Boring Program Summary* (*HLA, 1993d*). Additional groundwater information will be generated during the proposed monitoring/extraction well installation at the former AST location (*HLA, 1993f*). Analytical data from the upcoming investigation will be evaluated in the Mall RA.

2.2.1.3 Soil Gas

Soil gas surveys were conducted at the Mall in September 1991 and November 1992. The results of the September 1991 investigation were presented in the *Soil Gas and Groundwater Investigation* report (*HLA, 1991a*). Summaries of both the 1991 and 1992 soil gas

investigations are presented in *Supplemental Pilot Boring Sampling and Analysis Plan* (*HLA, 1993a*). Soil gas concentrations presented in those documents are summarized in Table 4.

2.2.2 Area 2: Westpark Area

Table 5 summarizes available groundwater data for Area 2 that will be evaluated in the PSA RA. Special Resource Management, Inc. (SRM), conducted several investigations to evaluate the extent and source of PCE detected in soil and groundwater is the area (*SRM, 1988; 1989*). As part of the Consent Order between Westpark and the Department, a groundwater treatment system began operating in March 1990 (Plate 2). Groundwater monitoring is conducted and reported to the Department quarterly during system operation. SRM groundwater data are included in Table 5, and will be used in the PSA RA.

In February 1993, HLA and VW&R collected groundwater samples from five SRM monitoring wells. Analytical results were reported in the *Quarterly Progress Report for January-March 1993* (*HLA, 1993c*).

In August 1992, HLA and VW&R collected groundwater samples from a well in Area 2 used for landscape irrigation at a business park. Results of that sampling event were described in the *Initial Groundwater Sampling Report* (*HLA, 1992d*). In March 1993, groundwater samples were collected from a well on Ash Park Lane by the Department. These data will be used in the PSA RA.

2.2.3 Area 3: Downgradient of Westpark Area

Table 6 summarizes available groundwater data to be evaluated in the PSA RA for Area 3. Groundwater samples have been collected from wells in Area 3 since approximately 1990. Groundwater data to be used for the PSA RA were collected by HLA and VW&R as part of the Initial Groundwater Sampling Event (*HLA, 1992*d) and Baseline Sampling Event (*HLA, 1993c*). One well designated as the Index Well has been sampled during each sampling event, and several additional times by HLA and/or VW&R. The data from the Index Well samples are not consistent with other well data in Area 3; therefore, data from this well are not presented in Table 6. The well will be evaluated separately since the measured groundwater concentrations range from 130 to 750 $\mu g/l$ for PCE. As shown in Table 6, PCE concentrations detected in samples from all other wells in Area 3 range from 1.0 to 35 $\mu g/l$. The Index Well is scheduled to be sampled in November 1993 as part of a quarterly sampling event; these data will be evaluated in the PSA RA.

2.2.4 Area 4: Outside the Affected Area

Data from areas outside the Affected Area were collected as part of the Initial Groundwater Sampling Event (*HLA, 1992d)* and Baseline Sampling Event (*HLA, 1993c*); the well data to be used to evaluate Area 4 are PCE concentrations less than the MCL of 5 $\mu g/l$ (Table 7). Wells in which PCE has been detected above the analytical detection limit but below the MCL of 5 $\mu g/l$ are sampled quarterly in accordance with a Consent Order negotiated between VW&R and the Department (Water Supply Order). These wells were sampled in May 1993 and again in August 1993. The results of these sampling events were reported in the *Quarterly Progress Report for April - June, 1993* (*HLA, 1993e*) and *Quarterly Progress Report for July through September, 1993 (HLA, 1993i)*. These wells are scheduled to be sampled again in November 1993; these analytical results will be used in the PSA RA. Two additional monitoring/extraction wells and one monitoring well are proposed for installation at the leading (most downgradient) edge of the Affected Area and between the Affected Area and Bali Hai Community Well, respectively (*HLA, 1993h*). Data to be obtained during the installation of these wells and from samples collected from the completed wells will be included in the RA.

2.2.5 Surface Water

In April 1992, VW&R and the Department collected surface water samples from eight

locations along the South Slough, and in July 1993, VW&R and HLA collected surface water samples from the South Slough. Results of both the April 1992 and July 1993 sampling events were presented in a letter to the Department dated August 3, 1993 (*HLA, 1993g*). These data are presented in Table 8 and will be used in the PSA RA. Some surface water sample locations are within Areas 3 and 4; those data will be addressed separately in interpreting Area 3 and 4 groundwater issues related to surface water.

3.0 PRELIMINARY LIST OF CHEMICALS OF POTENTIAL CONCERN

A list of chemicals of potential concern (COPCs) will be finalized in accordance with EPA guidelines (*EPA, 1989a; 1990c*) during preparation of the RA (Task 3, Section 5.3), based on the data identified as being useable for the RA (Task 2, Section 5.2). COPCs are those chemicals for which quantitative risk estimates will be developed. COPCs will be selected to represent the most prevalent, mobile, persistent, and toxic site-related chemicals for evaluation of their potential threats to human health and the environment.

The maximum detected groundwater concentrations of 1,2-DCE (total, includes the *cis* and *trans* isomers), PCE, and trichloroethene (TCE) are equal to or above the state and federal MCLs (Tables 3, 5, 6, and 7). Therefore, these three chemicals are expected to be evaluated in the PSA RA. Ethylbenzene and vinyl chloride, listed as COPCs in the Mall RA Work Plan, (*HLA, 1993*b), are no longer considered COPCs for Area 1: vinyl chloride has not been detected in soil or groundwater in Areas 1, 2, 3, and 4, and ethylbenzene is not related to the PCE plume in the PSA.

Medium- and chemical-specific federal- and State of Idaho-established concentrations previously identified in the Mall RA Work Plan (*HLA, 1993b*), collectively called screening concentrations, are presented in Table 9 for the three COPCs *(EPA 1990b, 1991a, 1992d; IDWR, 1992*). These concentrations are presented for screening purposes only and should not be considered as applicable or relevant and appropriate requirements (ARARs) or target remediation goals for soil and groundwater. EPA-established critical toxicity values identified in the Mall RA Work Plan (*HLA, 1993b*) are presented in Table 10 for the three COPCs.

4.0 PRELIMINARY EXPOSURE ANALYSIS

4.1 Introduction

A preliminary qualitative exposure assessment was conducted to evaluate the likelihood of occurrence and importance of potential exposure pathways at or near the site which may be complete. An exposure pathway links the source of a chemical with a receptor. An exposure pathway is considered complete and exposure is possible only if all of the following components are present:

- A chemical source or exposure medium
- A release and transport (i.e., migration) mechanism
- A receptor
- An exposure point
- An exposure route.

Exposure pathways which may be complete and are related to Areas 2, 3, and 4 are identified in Section 4.7, Table 11. Exposure pathways related to Area 1 were presented in the Mall RA Work Plan (*HLA, 1993b*). The following discussions pertain to the exposure pathways identified for Areas 2, 3, and 4 only.

A complete exposure assessment will be presented in the PSA RA as discussed in Section 5.5.

4.2 Chemical Sources

The AST used to store PCE at the former warehouse of the VW&R facility is a suspected source of soil contamination in Area 1 and subsequent groundwater contamination in Areas 2, 3, and 4. The groundwater will be considered the source of chemicals in Areas 2, 3, and 4 and addressed in the Mall and PSA RAs as summarized in Tables 1 and 11.

4.3 Release and Transport Mechanisms

Chemicals in groundwater can be released to the environment via volatilization into air, use of production wells for irrigation, groundwater discharge into surface water bodies, and surface water recharge to groundwater. The rate and magnitude of these releases depend on such factors as chemical concentrations in groundwater, aquifer properties, and the physical and chemical properties of the chemical (Table 12). Possible migration pathways related to the COPCs and other related chemicals in groundwater are briefly discussed below.

4.3.1 Migration Into Air

As discussed in the Mall RA Work Plan (*HLA, 1993b*), COPC vapors may migrate from groundwater to ambient air. As with the Mall RA, potential air-related exposure pathways will be evaluated in the PSA RA (Tables 1 and 11).

4.3.2 Migration Into Groundwater and Surface Water

Possible exposure pathways associated with the groundwater will be evaluated further in the PSA RA. The water solubility of the three COPCs detected in soil in Area 1, a potential source of chemicals in groundwater in the PSA, ranges from 150 to 1,100 mg/l (Table 12; *EPA, 1986b*) indicating the COPCs are susceptible to being introduced into groundwater by infiltration (e.g., rainwater). Although the tendency for these chemicals to volatilize to the air is greater than their tendency to remain dissolved, some competition between these processes will occur, and some chemicals will remain in the water, as indicated by the analytical chemistry data (Tables 3, 5, 6, 7). Infiltration was not considered a major migration pathway in areas 1, 2, 3, and 4. Infiltration of COPCs in soils is greatly reduced because of barriers such as the buildings and pavement over Area 1.

Additionally, the SVE treatment system in Area 1 is reducing chemical concentrations in soil, thereby reducing chemical migration from soil to groundwater in Areas 2, 3, and 4, as well as Area 1. Chemical concentrations in groundwater are not expected to exceed those reported in Tables 5, 6, and 7.

The physical and chemical properties of the COPCs and hydrogeologic conditions at the PSA indicate that groundwater may discharge into surface water bodies and surface water may recharge groundwater. The analysis of surface water samples indicate PCE is present in the South Slough (Table 8). Possible exposure pathways associated with COPCs detected in surface water will be further evaluated in the PSA RA. Possible exposure pathways such as inhalation of vapors from the slough were not presented in Table 11 because further evaluation of the hydrogeologic conditions and possible human and ecological receptors is needed.

4.3.3 Physical, Chemical and Biological Fate

Biological and chemical processes that occur in the soil and other media may influence the ultimate fate of the three COPCs (Plate 4). For example, under aerobic (oxygen-rich) conditions in the presence of methane, PCE can degrade to TCE, then to DCE, and then to VC (*Wilson and Wilson, 1984*); however, the extent and rates of these reactions are complex and difficult to predict. Degradation under anaerobic (oxygen-depleted) conditions has also been observed (*Bouwer et al., 1981; Kobayashi and Rittman, 1982*). The transformation progresses from PCE to TCE to 1,1-DCE, to VC, all ethene molecules with four, three, two, and one chlorine atoms, respectively *(Parsons et al., 1984; Cline and Viste, 1984*). The data summarized in Tables 1 through 8 indicate that some, if not all, of these processes have been taking place in soil, groundwater, and surface water. These processes be further evaluated in the RA; however, the treatment systems in place in Areas 1 and 2 are expected to reduce the concentrations of VOCs and their degradation products in soil and groundwater.

4.4 Potential Receptors

The users of groundwater in Areas 2, 3, and 4 identified in Sections 2.1.2, 2.1.3, and 2.1.4 will be considered for evaluation as potential receptors, as shown in Table 11.

4.5 Exposure Points

An exposure point is a location where an individual or population (i.e., a receptor) could potentially be exposed to chemicals originating at the site. Hypothetical receptor locations for which exposure point concentrations may be estimated in each medium of concern will be identified in the PSA RA.

4.6 Exposure Routes

An exposure route is the way in which a chemical comes in contact with or is absorbed by an organism. Exposure routes by which potential receptors might be exposed include inhalation (of vapors in air), ingestion (of groundwater) and dermal contact (with groundwater). These three routes will be considered in the RA.

4.7 Possible Complete Exposure Pathways

Based on this preliminary analysis, four possibly complete exposure pathways will be considered for evaluation in the PSA RA (Table 11):

- Inhalation of vapors resulting from volatilization of chemicals in groundwater by commercial workers in Area 2 and residents in Areas 3 and 4
- Ingestion of groundwater as a drinking water source by commercial workers in Areas 2 and 4 and residents in Areas 3 and 4
- Dermal contact with groundwater during showering by commercial workers in Areas 2 and 4 and residents in Areas 3 and 4
- Inhalation of vapors released from groundwater during showering by commercial workers in Areas 2 and 4 and residents in Area 3 and 4

The completeness of these exposure pathways will be further evaluated in the PSA RA (Section 5.5).

5.0 SCOPE OF WORK

The RA will use the preliminary evaluation presented herein and the data to be collected during the activities described in the Monitoring Well Sampling and Analysis Plan (MW SAP; *HLA, 1993f*) and Soil Boring SAP (*HLA, 1993h*) and September 1993 Quarterly Progress Report (*HLA, 1993i*), and will be prepared in accordance with EPA guidelines for RA *(EPA, 1989a, b; 1990a, b, c; 1991b, c, d)*. The results of the RA will be used to develop preliminary remediation goals (PRGs) for chemicals and media expected to be potential human or environmental health risks, as needed. PRGs are concentrations that are expected to be protective of human health and the environment.

The objectives of the RA are to:

- Evaluate the potential for human health and environmental impacts associated with the presence of site-related chemicals
- Provide a basis for risk management decisions
- Provide PRGs for future remediation, as needed.

This section summarizes the proposed scope of work for the PSA RA to be completed upon evaluation of analytical data from the investigations described in the MW SAP (*HLA, 1993f*) and Soil Boring SAP (*HLA, 1993h*). The proposed scope of work is divided into 10 tasks, briefly discussed below.

5.1 Task 1 - Background and Site History

This section of the report will provide information on site history and background. Additional information compiled as part of the activities described in the MW SAP and Soil Boring SAP (*HLA, 1993f; HLA, 1993h*) will be included in the RA report.

5.2 Task 2 - Data Evaluation

HLA will employ data validation and quality assurance/quality control (QA/QC) measures during all additional field investigations in the PSA as described in the Quality Assurance Project Plan (*HLA, 1992c*) to provide data of adequate quality for use in the RA. Existing HLA and other analytical data for the site will also be reviewed to identify a usable dataset for RA (*EPA, 1990c*). Updated data summary sheets similar to those presented in Tables 2 through 8 will be generated. These data will be used to identify COPCs (Task 3, Section 5.3) and possible exposure point concentrations (Task 5, Section 5.5).

5.3 Task 3 - Selection of Chemicals of Potential Concern

A final list of COPCs for each of the areas will be identified consistent with EPA guidance for data evaluation. This list will be based on the dataset identified in Task 2 and methods consistent with EPA guidance. Surface water criteria such as federal ambient water quality criteria (AWQC) will also be tabulated to evaluate chemical(s) detected in surface water.

5.4 Task 4 - Toxicity Assessment

HLA will update, if necessary, the toxicity values presented in Table 10 based on any updates to EPA's Integrated Risk Information System (IRIS) database and Health Effects Assessment Summary Tables (*EPA, 1985a, b; 1986a; 1987; 1991b; 1992a, b, c, e*) or any additional COPCs. Brief toxicity profiles describing the potential noncarcinogenic and carcinogenic effects of each of the COPCs will be presented. This information will be used in risk characterization (Task 6, Section 5.6).

5.5 Task 5 - Exposure Assessment

A final list of potentially complete human exposure pathways for each of the three PSA areas will be identified based upon further evaluation of available data. Possible doses to

hypothetical receptors will be estimated to evaluate reasonable maximum exposures (RMEs) and typical average exposures in each area. Exposure point concentrations will be estimated for each receptor identified in an area, as needed, using either measured concentrations or models developed for exposure assessments and consistent with EPA guidelines (*EPA, 1989a*).

5.6 Task 6 - Risk Characterization

The likelihood and possible severity of adverse effects to humans resulting from exposure to the COPCs in each area for each type of exposure scenario will be analyzed. For noncarcinogenic chemicals, HLA will compare exposure estimates to EPA-established reference doses (RfDs). This will provide a chemical and receptor-specific hazard quotient (HQ). To evaluate multipathway exposures, HQs may be summed to derive a hazard index (HI). An HQ or HI less than 1.0 indicates a low probability of adverse noncancer health effects; an HQ or HI greater than 1.0 indicates a potential for adverse noncancer health effects. For carcinogens, EPA-established slope factors (SFs) and risk-estimation models will be used to estimate cancer risks.

5.7 Task 7 - Ecological Risk Assessment

HLA will conduct a qualitative evaluation of potential impacts to ecological receptors. Possible ecological receptors (e.g., birds), if any, will be identified and potential adverse effects to these receptors will be qualitatively discussed.

5.8 Task 8 - Uncertainty Analysis

This task consists of a semiquantitative evaluation of uncertainties inherent in the PSA RA. The uncertainty analysis will identify individual components and approaches used in the RA and rate the potential for concern to over- or underestimate risks. The risk assessor's professional judgement will be used to assign ratings of low, moderate, or high uncertainty to components and approaches that may yield differences in risk estimates, as recommended by EPA (*1989a*). A "low" rating will be assigned to approaches that may yield differences in risk of less than an order of magnitude, "moderate" ratings will be assigned to differences of between one and two orders of magnitude, and "high" ratings will be given differences of more than two orders of magnitude (*EPA, 1989a*). The general impact of the uncertainties in the overall RA can be assessed based on a review of this summary table.

5.9 Task 9 - Development of Preliminary Remediation Goals

Based on the results of the RA, health risk-based PRGs for each medium of concern (*EPA, 1991d*) or promulgated regulatory standards (e.g., MCLs) for groundwater will be identified for COPCs that may pose unacceptable human or environmental health risks. EPA methods for development of PRGs will be used (*EPA, 1991e*) if promulgated regulatory standards do not exist or are not appropriate. The PRGs and promulgated standards will be considered in the RAP for possible implementation of corrective measures in any of the PSA areas.

5.10 Task 10 - Report Preparation

HLA will prepare a preliminary draft report for review by VW&R. The results of the RA will be presented in both tabular and narrative form. Comments by VW&R will be incorporated into the report, and a draft report will be submitted to the Department. The final report will be prepared following review by VW&R and the Department, and the incorporation of comments to the draft.

6.0 SCHEDULE

The RA report schedule will be submitted to VW&R and the Department 30 days after written notification of approval of the Work Plan is received from the Department or completion of field activities described in Section 5.0, whichever is later.

7.0 REFERENCES

Bouwer, E.J., B.E. Rittman, and P.L. McCarthy, 1981. Anaerobic Degradation of Halogenated 1- and 2-Carbon Compounds. *Environ. Sci. Technol.* 15:596-599.

Chen-Northern, Inc., 1991. Letter to Rob Howarth, Division of Environmental Quality, Idaho Department of Health and Welfare. July 23.

Cline, P.V., and D.R. Viste, 1984. Migration of Degradation Patterns of Volatile Organic Compounds. *Haz. Waste Conf.* 217-220.

Conde, D.M., 1991. State of Idaho Office of the Attorney General. Letter to Wayne Grotheer, Van Waters & Rogers Inc. July 18.

GZA Geo Environmental, Inc., 1991. *Environmental Site Evaluation, Boise Townee Square, Boise, Idaho.* August.

Harding Lawson Associates (HLA), 1991a. *Soil Gas and Groundwater Investigation, Former VW&R Facility, Boise, Idaho.* October 25.

_____, 1991b. *Soil Boring Investigation, Former VW&R Facility, Boise, Idaho.* December 17.

_____, 1992a. *Exhibit #1, Work Plan, Preliminary Study Area Investigation, Boise, Idaho.* September 8.

_____, 1992b. *Exhibit #3, Work Plan, Boise Towne Square Mall Supplemental Investigation and Final Remediation, Boise, Idaho.* September 8.

_____, 1992c. *Quality Assurance Project Plan, Boise Mall and Preliminary Study Area Work Plans, Boise, Idaho.* November 2.

_____, 1992d. *Initial Groundwater Sampling Report, Preliminary Affected Area, Water Supply Order, Boise, Idaho.* November 17.

_____, 1993a. *Supplemental Pilot Boring Sampling and Analysis Plan, Boise Towne Square Mall, Boise, Idaho.* February 9.

_____, 1993b. *Risk Assessment Work Plan, Boise Mall Order, Boise, Idaho.* March 4, 1993

_____, 1993c. *Quarterly Progress Report, January-March 1993, Boise, Idaho.* March 24.

_____, 1993d. *Pilot Boring Program Summary, Boise Towne Square Mall, Boise, Idaho.* Letter to Wayne Grotheer, Van Water & Rogers Inc. May 11.

_____, 1993e. *Quarterly Progress Report, April-June 1993, Boise, Idaho.* June 22.

_____, 1993f. *Monitoring Well Sampling and Analysis Plan, Boise Towne Square Mall Order, Boise, Idaho.* July 20.

_____, 1993g. *South Slough Seepage Study and Sampling, Preliminary Study Area, Boise Idaho.* Letter to Ron Lane, Idaho Department of Health and Welfare, Division of Environmental Quality. August 3.

_____, 1993h. *Soil Boring Sampling and Analysis Plan, Preliminary Study Area Order, Boise, Idaho.* August 13.

_____, 1993i. *Quarterly Progress Report, July - September 1993, Boise, Idaho.* September.

Idaho Department of Health and Welfare, (IDHW), 1992a. *Fact Sheet: Tetrachloroethylene (Perc).* January 3.

_____, 1992b. *Boise Mall Consent Order between Van Waters & Rogers Inc., and Idaho Department of Health and Welfare,* September 24, as amended October 9.

Industrial Health Incorporated-Environmental (IHI), 1992. *Monitoring Well Sampling, Boise Towne Square Mall, Boise, Idaho.* June.

Kobayashi, H., and Rittman, B.E., 1982. Microbial Removal of Hazardous Organic Compounds. *Environ, Sci. Technol.* 16:170a-183A.

Parsons, F., P.R. Wood, and J. DeMarco, 1984. Transformation of Perchlorethylene and Trichloroethene. *Microcosms and Groundwater Research and Technology*, 56-59.

Special Resource Management, Inc. (SRM), 1988. *Environmental Assessment II for the Proposed Westpark Commercial Center, Boise, Idaho*. March.

_____, 1989. *Groundwater Remedial Action Plan for the Westpark Commercial Center, Boise, Idaho*. January.

State of Idaho Drinking Water Regulations (IDWR), 1992. IDAPA 16.01. 08900,03. August.

State of Idaho Groundwater Plan (IGP), 1992. 1992 Session Law, Chapter 310, p. 992.

U.S. Environmental Protection Agency (EPA), 1985a. *Health Assessment Document for Tetrachloroethylene (Perchloroethylene)*. Final Report. Office of Health and Environmental Assessment. PB85-249704. July.

_____, 1985b. *Health Assessment Document for Trichloroethylene*. Final Report. Office of Health and Environmental Assessment. PB85-249696. July.

_____, 1986a. *Updated Carcinogenicity Assessment for Tetrachloroethylene (Perchloroethylene, PERC, PCE): Addendum to the Health Assessment Document for Tetrachloroethylene*. Office of Health and Environmental Assessment. PB86-174489. April.

_____, 1986b. *Superfund Public Health Evaluation Manual*. Office of Solid Waste and Emergency Response. EPA/540/1-86-/060. OSWER Directive 9285.4-1. October.

_____, 1987. *Addendum to the Health Assessment Document for Trichloroethylene. Updated Carcinogenicity Assessment for Trichloroethylene*. External Review Draft. Office of Health and Environmental Assessment. PB87-228045. June.

_____, 1989a. *Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual. Interim Final*. Office of Emergency and Remedial Response. Washington, D.C. EPA/540/1-89/002.

_____, 1989b. *Risk Assessment Guidance for Superfund. Volume II: Environmental Evaluation Manual. Interim Final*. Office of Emergency and Remedial Response. Washington, D.C. EPA/540/189-001.

_____, 1990a. *Statement of Work RI/FS Risk Assessment, Exposure Assumptions*. Seattle, Washington. January.

_____, 1990b. *Guidance for Data Usability in Risk Assessment*. Office of Solid Waste and Emergency Response. EPA/540/G-90/008.

_____, 1990c. National Oil and Hazardous Substances Pollution Contingency Plan: Final Rule. *Federal Register*. SS(46):8665-8865.

_____, 1991a. National Primary Drinking Water Regulations; Final Rule. *Federal Register 56:3526-3597*. January 30.

_____, 1991b. *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*. Office of Emergency and Remedial Response. Directive No. 9285.6-03. March 25.

_____, 1991c. *Supplemental Risk Assessment Guidance for Superfund*. Region 10. August 16. August 1992 update.

_____, 1991d. *Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals, Part C. Risk Evaluation of Remedial Alternatives)*. Office of Emergency and Remedial Response. Publication 9285.7-01B. December.

_____, 1992a. *Integrated Risk Information System (IRIS)*. Online database, updated through October 31, 1992.

_____, 1992b. *Health Effects Assessment Summary Tables (HEAST), Annual FY-1992*. Office of Solid Waste and Emergency Response. PB92-921199. March.

_____, 1992c. *Scripts for Superfund Technical Support Center Questions on Tetrachloroethylene, Trichloroethylene, and Styrene.* Office of Health and Environmental Assessment April/May.

_____, 1992d. *Drinking Water Regulations and Health Advisories.* Office of Water, Safe Drinking Water Hotline. Washington, D.C. December.

Wilson, J.T., and B.H. Wilson, 1984. Biotransformation of Trichloroethene in Soil. *Appl. Environ. Microbio. 242-243.*

TABLES

Table 1. Conceptual Model of Mall and PSA Risk Assessments
Risk Assessment Work Plan
Preliminary Study Area
Boise, Idaho

Receiving Medium	Release Mechanism	Release Source	Risk Assessment Expected to Address Issue	Comments
Soil	Direct contact (ingestion and dermal contact)	Contaminated soil	Mall	Chemicals present in soil in Mall area only
Air	Volatilization to indoor and outdoor air (inhalation)	Contaminated soil and groundwater plume	Mall	Volatile chemicals present in soil and groundwater in Mall area
Air	Volatilization to indoor and outdoor air (inhalation)	Groundwater plume	PSA	Volatile chemicals present in groundwater at PSA; possible dispersion from chemicals in soil and groundwater from Mall area may need to also be considered for receptors in PSA
Groundwater	Drinking water withdrawal (ingestion and inhalation)	Groundwater plume	PSA	Drinking water wells, i.e. potential receptors, present in PSA only
	Soil infiltration and chemical migration to groundwater	Contaminated soil	PSA	Chemicals present in soil in Mall area only. Soil infiltration and possible chemical migration to groundwater in PSA not expected to change current groundwater concentrations being evaluated for PSA and Mall
Surface water	Groundwater discharge to surface water	Groundwater plume	PSA	Surface water and corresponding receptors are located in PSA only
Biota	Uptake (direct contact, ingestion, inhalation)	Contaminated soil, surface water, sediment groundwater, or air, or other biota	PSA	Ecological receptors expected to be related to surface water habitats only

Table 2. Statistical Data Summary of Chemical Analyses for Soil Samples
Mall - Area 1
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Benzene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Bromobenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Bromochloromethane	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Bromodichloromethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Bromoform	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Bromomethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
n-Butylbenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
sec-Butylbenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
tert-Butylbenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Carbon tetrachloride	mg/kg	1 / 14	7.1%	0.18	9.50	0.18	9.50	0.38	0.90	2.14	0.18
Chlorobenzene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Chloroethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Chloroform	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Chloromethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
2-Chlorotoluene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
4-Chlorotoluene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Dibromochloropropane	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Dibromochloromethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,2-Dibromoethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloroethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	mg/kg	3 / 14	21.4%	0.01	12.50	1.30	5.50	0.50	0.92	2.30	1.30
trans-1,2-Dichloroethene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloropropane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,3-Dichloropropane	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
2,2-Dichloropropane	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloropropene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	mg/kg	0 / 12	0.0%	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	mg/kg	0 / 12	0.0%	--	--	--	--	--	--	--	--
Ethylbenzene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Isopropylbenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
p-Isopropyltoluene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Methylene bromide	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Methylene chloride	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
n-Propylbenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Styrene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
1,1,1,2-Tetrachloroethane	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Tetrachloroethylene	mg/kg	14 / 14	100.0%	0.01	12.00	26000.00	5.50	2895.43	6794.82	16213.28	16213.28
Toluene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	mg/kg	1 / 14	7.1%	0.02	8.00	0.02	8.00	0.37	0.90	2.14	0.02
1,1,2-Trichloroethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Trichloroethene	mg/kg	4 / 14	28.6%	0.40	9.50	3.10	5.50	0.76	1.14	2.98	2.98
Trichlorofluoromethane	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--

Table 2. Statistical Data Summary of Chemical Analyses for Soil Samples
Mall - Area 1
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Vinyl chloride	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Xylenes (total)	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
SOCs											
1,2-Dichlorobenzene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	mg/kg	0 / 14	0.0%	--	--	--	--	--	--	--	--
Hexachlorobutadiene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
Naphthalene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	mg/kg	0 / 2	0.0%	--	--	--	--	--	--	--	--
TPH											
TPH-Diesel	mg/kg	0 / 12	0.0%	--	--	--	--	--	--	--	--
TPH-Gasoline	mg/kg	0 / 12	0.0%	--	--	--	--	--	--	--	--
INORGANICS											
Moisture	%	12 / 12	100.0%	3.50	12.00	18.00	4.50	9.93	4.86	19.44	18.00

Note:
mg/kg= milligrams per kilogram
% = percent moisture

Table 3. Statistical Data Summary of Chemical Analyses for Groundwater Samples
Mall - Area 1
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Benzene	ug/l	0 / 7	0.0%	--	--	--	--	--	--	--	--
Bromodichloromethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Bromoform	ug/l	0 / 11	0.0%	--	--	--	--	--	--	--	--
Bromomethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Carbon tetrachloride	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Chlorobenzene	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Chloroethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Chloroform	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Chloromethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Dibromochloromethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
1,2-Dibromoethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethene	ug/l	1 / 12	8.3%	1.60	--	1.60	--	3.54	7.09	17.43	1.60
1,2-Dichloroethene	ug/l	1 / 2	50.0%	63.00	--	63.00	--	31.63	44.37	118.59	63.00
cis-1,2-Dichloroethene	ug/l	2 / 10	20.0%	38.00	--	40.00	--	8.37	16.22	40.17	40.00
trans-1,2-Dichloroethene	ug/l	0 / 10	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Ethylbenzene	ug/l	0 / 7	0.0%	--	--	--	--	--	--	--	--
1,1,2-Trichloro-1,2,2-Trifluo	ug/l	0 / 2	0.0%	--	--	--	--	--	--	--	--
Methylene chloride	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Tetrachloroethylene	ug/l	7 / 12	58.3%	2.10	--	5100.00	--	1018.23	1724.97	4399.17	4399.17
Toluene	ug/l	0 / 7	0.0%	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	ug/l	2 / 12	16.7%	0.20	--	2.00	--	3.57	7.08	17.44	2.00
1,1,2-Trichloroethane	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Trichloroethene	ug/l	4 / 12	33.3%	1.90	--	70.00	--	8.48	19.90	47.48	47.48
Trichlorofluoromethane	ug/l	0 / 10	0.0%	--	--	--	--	--	--	--	--
Vinyl chloride	ug/l	0 / 12	0.0%	--	--	--	--	--	--	--	--
Xylenes (total)	ug/l	0 / 7	0.0%	--	--	--	--	--	--	--	--
SOCs											
1,2-Dichlorobenzene	ug/l	0 / 10	0.0%	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/l	0 / 10	0.0%	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/l	0 / 10	0.0%	--	--	--	--	--	--	--	--

Note:
ug/l = micrograms per liter

Table 4. Statistical Data Summary of Chemical Analyses for Soil Gas Samples
Mall - Area 1
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Benzene	ug/l	5 / 37	13.5%	0.03	--	1.00	--	0.03	0.16	0.36	0.36
cis-1,2-Dichloroethene	ug/l	18 / 79	22.8%	0.57	--	540.00	6.00	24.92	91.69	204.63	204.63
trans-1,2-Dichloroethene	ug/l	6 / 79	7.6%	0.02	--	2.20	7.00	0.05	0.27	0.59	0.59
Ethylbenzene	ug/l	16 / 48	33.3%	0.04	--	1200.00	6.50	92.28	258.54	599.02	599.02
Tetrachloroethylene	ug/l	63 / 79	79.8%	0.11	7.00	5500.00	6.50	597.93	1274.74	3096.43	3096.43
Toluene	ug/l	6 / 37	16.2%	0.03	--	0.11	--	0.02	0.03	0.08	0.08
Trichloroethene	ug/l	44 / 79	55.7%	0.03	9.00	1800.00	9.00	44.27	212.33	460.45	460.45
Vinyl Chloride	ug/l	3 / 79	3.8%	0.53	--	5.80	7.00	0.13	0.75	1.59	1.59
VOCs (total)	ug/l	77 / 79	97.5%	2.72	--	55000.00	9.00	2454.17	9241.18	20566.89	20566.89
m&p-Xylenes	ug/l	4 / 37	10.8%	0.07	--	0.21	--	0.02	0.05	0.11	0.11
o-Xylene	ug/l	2 / 37	5.4%	0.06	--	0.39	--	0.02	0.06	0.14	0.14

Note:
ug/l = micrograms per liter

Table 5. Statistical Data Summary of Chemical Analyses for Groundwater Samples
PSA - Area 2
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Bromodichloromethane	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Bromoform	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Bromomethane	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Carbon tetrachloride	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Chlorobenzene	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Chloroethane	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
2-Chloroethyl vinyl ether	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Chloroform	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Chloromethane	ug/l	1 / 5	20.0%	16.00	--	16.00	--	13.80	21.25	55.46	16.00
Dibromochloromethane	ug/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
1,2-Dibromoethane	ug/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethene	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	ug/l	2 / 4	50.0%	1.20	--	1.40	--	1.93	2.13	6.10	1.40
trans-1,2-Dichloroethene	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Methylene chloride	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Methyl ethyl ketone	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,1,1,2-Tetrachloroethane	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Tetrachloroethylene	ug/l	162 / 162	100.0%	0.60	--	2400.00	--	445.47	437.77	1303.51	1303.51
1,1,1-Trichloroethane	ug/l	1 / 5	20.0%	0.90	--	0.90	--	1.32	2.08	5.40	0.90
1,1,2-Trichloroethane	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Trichloroethene	ug/l	53 / 90	58.9%	0.60	--	12.10	--	2.13	2.44	6.91	6.91
Trichlorofluoromethane	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
Vinyl chloride	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
SOCs											
1,2-Dichlorobenzene	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/l	0 / 5	0.0%	--	--	--	--	--	--	--	--
METALS											
Aluminum	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Copper	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Iron	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Magnesium	ug/l	1 / 1	100.0%	28000.00	--	28000.00	--	--	--	--	--
Manganese	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Potassium	ug/l	1 / 1	100.0%	3000.00	--	3000.00	--	--	--	--	--
Zinc (total)	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
INORGANICS											
Alkalinity as CaCO3	mg/l	1 / 1	100.0%	250.00	--	250.00	--	--	--	--	--

Table 5. Statistical Data Summary of Chemical Analyses for Groundwater Samples
PSA - Area 2
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
INORGANICS											
Bicarbonate	mg/l	1 / 1	100.0%	310.00	--	310.00	--	--	--	--	--
Calcium	ug/l	1 / 1	100.0%	59000.00	--	59000.00	--	--	--	--	--
Carbonate	mg/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Chloride	mg/l	1 / 1	100.0%	23.00	--	23.00	--	--	--	--	--
Conductivity	umhos	1 / 1	100.0%	660.00	--	660.00	--	--	--	--	--
Hardness	mg/l	1 / 1	100.0%	260.00	--	260.00	--	--	--	--	--
Hydroxide	mg/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
MBAS	mg/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Nitrate	mg/l	1 / 1	100.0%	3.90	--	3.90	--	--	--	--	--
Sodium	ug/l	1 / 1	100.0%	39000.00	--	39000.00	--	--	--	--	--
Sulfate	mg/l	1 / 1	100.0%	73.00	--	73.00	--	--	--	--	--
Total Dissolved Solids	mg/l	1 / 1	100.0%	460.00	--	460.00	--	--	--	--	--
pH	pH	1 / 1	100.0%	7.80	--	7.80	--	--	--	--	--

Note:
mg/l = milligrams per liter
ug/l = micrograms per liter
pH = standard pH units
umhos= micro mhos per centimeter

Table 6. Statistical Data Summary of Chemical Analyses for Groundwater Samples
PSA - Area 3
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Bromodichloromethane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Bromoform	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Bromomethane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Carbon tetrachloride	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Chlorobenzene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Chloroethane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
2-Chloroethyl vinyl ether	ug/l	0 / 6	0.0%	--	--	--	--	--	--	--	--
Chloroform	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Chloromethane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Dibromochloromethane	ug/l	0 / 16	0.0%	--	--	--	--	--	--	--	--
1,2-Dibromoethane	ug/l	0 / 16	0.0%	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	ug/l	0 / 6	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/l	0 / 16	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	ug/l	0 / 16	0.0%	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Methylene chloride	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Methyl ethyl ketone	ug/l	0 / 6	0.0%	--	--	--	--	--	--	--	--
1,1,1,2-Tetrachloroethane	ug/l	0 / 6	0.0%	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Tetrachloroethylene	ug/l	22 / 22	100.0%	1.00	--	35.00	--	7.35	8.51	24.03	24.03
1,1,1-Trichloroethane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Trichloroethene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
Trichlorofluoromethane	ug/l	1 / 22	4.6%	0.70	--	0.70	--	0.55	1.00	2.52	0.70
Vinyl chloride	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
SOCs											
1,2-Dichlorobenzene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/l	0 / 22	0.0%	--	--	--	--	--	--	--	--
METALS											
Aluminum	ug/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
Copper	ug/l	2 / 4	50.0%	40.00	--	50.00	--	30.00	17.80	64.88	50.00
Iron	ug/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
Magnesium	ug/l	4 / 4	100.0%	12000.00	--	17000.00	--	14750.00	2061.55	18790.64	17000.00
Manganese	ug/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
Potassium	ug/l	4 / 4	100.0%	2000.00	--	2000.00	--	2000.00	--	2000.00	2000.00
Zinc (total)	ug/l	3 / 4	75.0%	30.00	--	90.00	--	52.50	38.62	128.20	90.00
INORGANICS											
Alkalinity as CaCO3	mg/l	4 / 4	100.0%	210.00	--	250.00	--	230.00	16.33	262.01	250.00

Table 6. Statistical Data Summary of Chemical Analyses for Groundwater Samples
PSA - Area 3
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
INORGANICS											
Bicarbonate	mg/l	4 / 4	100.0%	250.00	--	310.00	--	280.00	24.49	328.01	310.00
Calcium	ug/l	4 / 4	100.0%	38000.00	--	49000.00	--	43750.00	4573.47	52714.01	49000.00
Carbonate	mg/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
Chloride	mg/l	4 / 4	100.0%	6.00	--	14.00	--	8.65	3.65	15.81	14.00
Conductivity	umhos	4 / 4	100.0%	420.00	--	530.00	--	482.50	51.88	584.19	530.00
Hardness	mg/l	4 / 4	100.0%	160.00	--	180.00	--	170.00	11.55	192.63	180.00
Hydroxide	mg/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
MBAS	mg/l	0 / 4	0.0%	--	--	--	--	--	--	--	--
Nitrate	mg/l	4 / 4	100.0%	1.70	--	2.20	--	1.93	0.26	2.44	2.20
Sodium	ug/l	4 / 4	100.0%	29000.00	--	54000.00	--	44500.00	12013.88	68047.21	54000.00
Sulfate	mg/l	4 / 4	100.0%	15.00	--	34.00	--	23.50	8.66	40.47	34.00
Total Dissolved Solids	mg/l	4 / 4	100.0%	270.00	--	340.00	--	312.50	30.96	373.18	340.00
pH	pH	4 / 4	100.0%	7.40	--	7.70	--	7.55	0.13	7.80	7.70

Note:
mg/l = milligrams per liter
ug/l = micrograms per liter
pH = standard pH units
umhos= micro mhos per centimeter

Table 7. Statistical Data Summary of Chemical Analyses for Groundwater Samples
PSA - Area 4
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Benzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Bromobenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Bromochloromethane	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Bromodichloromethane	ug/l	1 / 48	2.1%	1.30	--	1.30	--	1.35	7.18	15.41	1.30
Bromoform	ug/l	1 / 48	2.1%	3.40	--	3.40	--	1.39	7.18	15.47	3.40
Bromomethane	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
n-Butylbenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
sec-Butylbenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
tert-Butylbenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Carbon tetrachloride	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
Chlorobenzene	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
Chloroethane	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
2-Chloroethyl vinyl ether	ug/l	0 / 23	0.0%	--	--	--	--	--	--	--	--
Chloroform	ug/l	1 / 48	2.1%	0.40	--	0.40	--	1.34	7.18	15.40	0.40
Chloromethane	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
2-Chlorotoluene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
4-Chlorotoluene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Dibromochloromethane	ug/l	0 / 25	0.0%	--	--	--	--	--	--	--	--
1,2-Dibromoethane	ug/l	0 / 25	0.0%	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	ug/l	0 / 24	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/l	0 / 25	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethene	ug/l	1 / 48	2.1%	1.20	--	1.20	--	0.39	0.52	1.40	1.20
cis-1,2-Dichloroethene	ug/l	0 / 25	0.0%	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
1,3-Dichloropropane	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
2,2-Dichloropropane	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloropropene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
Ethylbenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Isopropylbenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
p-Isopropyltoluene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Dibromomethane	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Methylene chloride	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
Methyl ethyl ketone	ug/l	0 / 23	0.0%	--	--	--	--	--	--	--	--
n-Propylbenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Styrene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,1,1,2-Tetrachloroethane	ug/l	0 / 24	0.0%	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
Tetrachloroethylene	ug/l	25 / 60	41.7%	0.20	--	3.70	--	0.81	0.89	2.56	2.56
Toluene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	ug/l	1 / 48	2.1%	0.40	--	0.40	--	2.38	14.39	30.59	0.40
1,1,2-Trichloroethane	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
Trichloroethene	ug/l	0 / 56	0.0%	--	--	--	--	--	--	--	--
Trichlorofluoromethane	ug/l	2 / 48	4.2%	0.60	--	0.90	--	0.44	0.34	1.10	0.90
1,2,3-Trichloropropane	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--

Table 7. Statistical Data Summary of Chemical Analyses for Groundwater Samples
PSA - Area 4
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
1,2,4-Trimethylbenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Vinyl chloride	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
m & p-Xylenes	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
o-Xylene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
SOCs											
1,2-Dichlorobenzene	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/l	0 / 48	0.0%	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
Naphthalene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	ug/l	0 / 1	0.0%	--	--	--	--	--	--	--	--

Note:
ug/l = micrograms per liter

Table 8. Statistical Data Summary of Chemical Analyses for Surface Water Samples
PSA
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Benzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Bromobenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Bromochloromethane	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Bromodichloromethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Bromoform	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Bromomethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
n-Butylbenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
sec-Butylbenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
tert-Butylbenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Carbon tetrachloride	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Chlorobenzene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Chloroethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Chloroform	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Chloromethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
2-Chlorotoluene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
4-Chlorotoluene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Dibromochloromethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,2-Dibromoethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Dibromomethane	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloroethene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,3-Dichloropropane	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
2,2-Dichloropropane	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,1-Dichloropropene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Ethylbenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Isopropylbenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
p-Isopropyltoluene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Methylene chloride	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
n-Propylbenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Styrene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,1,1,2-Tetrachloroethane	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Tetrachloroethylene	ug/l	16 / 20	80.0%	0.35	--	6.89	--	1.86	2.10	5.96	5.96
Toluene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Trichloroethene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Trichlorofluoromethane	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--

Table 8. Statistical Data Summary of Chemical Analyses for Surface Water Samples
PSA
Van Waters & Rogers - Boise, Idaho

Parameter	Units	Number of Detects/Analyses	Frequency of Detect	Minimum Detected Value	Depth of Min (ft)	Maximum Detected Value	Depth of Max (ft)	Arithmetic Mean	Standard Deviation of the Arithmetic Mean	95% Upper Confidence Limit of the Arithmetic Mean	Lesser of 95% Upper Confidence Limit and Maximum
VOCs											
Vinyl chloride	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
m & p-Xylenes	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
o-Xylene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
SOCs											
1,2-Dichlorobenzene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/l	0 / 20	0.0%	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
Naphthalene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	ug/l	0 / 9	0.0%	--	--	--	--	--	--	--	--

Note:
ug/l = micrograms per liter

Table 9. Screening Criteria for Chemicals of Potential Concern
Risk Assessment Work Plan
Preliminary Study Area
Boise, Idaho

Chemicals of Potential Concern	PROPOSED RCRA ACTION LEVELS /a/		PROPOSED RCRA MEDIA PROTECTION STANDARDS (Minimum to Maximum Concentrations) /b/		EPA REGION X RISK-BASED CONCENTRATIONS /c/				FEDERAL DRINKING WATER STANDARD /b/	STATE DRINKING WATER STANDARD /e/
					Water (µg/l)		Soil (mg/kg)			
	Water (µg/l) /g/	Soil (mg/kg) /h/	Water (µg/l)	Soil (mg/kg)	Cancer	Noncancer	Cancer	Noncancer	MCL /f/ (µg/l)	MCL (µg/l)
1,2-Dichloroethene (total) /i/	NA /j/	NA	NA	NA	NA	40	NA	300	70	70
Tetrachloroethene	0.7	10	0.7-70	10-1000	2	40	1	300	5	5
Trichloroethene	NA	60	3-300	60-6000	3	20	6	200	5	5

/a/ EPA, 1990b.
/b/ EPA, 1990b. Minimum and maximum concentration represents a target risk level of 1 x 10^-6 and 1 x 10^-4, respectively for carcinogens in the medium.
/c/ EPA, 1991a.
/d/ EPA, 1992d.
/e/ IDWR, 1992.
/f/ Maximum contaminant level.
/g/ µg/l = Micrograms per liter.
/h/ mg/kg = Milligrams per kilogram.
/i/ Values based on cis-DCE, the more toxic isomer.
/j/ NA = Not available.

Table 10. Reference Doses and Slope Factors for Chemicals of Potential Concern
Risk Assessment Work Plan
Preliminary Study Area
Boise, Idaho

Chemicals of Potential Concern	CHRONIC REFERENCE DOSE (mg/kg/day)				SLOPE FACTOR (mg/kg/day)$^{-1}$					
	Oral	Source	Inhalation	Source	Oral	Source	Inhalation	Source	Weight of Evidence /a/	Source
Tetrachloroethene	1.00E−02	EPA, 1992a	NA /b/	EPA, 1992a	5.20E−02	EPA, 1985a /c/	2.00E−03	EPA, 1986a /c/	B2	EPA, 1991b /d/
1,2−Dichloroethene (total)	9.00E−03	EPA, 1992e	NA	EPA, 1992e	NA	EPA, 1992b	NA	EPA, 1992b	NA	EPA, 1992a
Trichloroethene	NA	EPA, 1992a	NA	EPA, 1992a	1.10E−02	EPA, 1985b /c/	6.00E−03	EPA, 1987 /c/	B2	EPA, 1991b /d/

/a/ Weight−of−evidence ratings are: A = known human carcinogen; B2 = probable human carcinogen; C = possible human carcinogen; D = not classified (EPA, 1989).
/b/ NA = Not available or not applicable.
/c/ Slope factors (SFs) for perchloroethylene and trichloroethene have been withdrawn (EPA 1992a). For the purposes of the risk assessment, SFs from previous EPA reports were used (EPA, 1985a,b; 1986a; 1987) on the recommendation of EPA (1992c).
/d/ EPA's Integrated Risk Information System (IRIS; EPA, 1992a) has withdrawn weight−of−evidence ratings (WOEs) for perchloroethylene and trichloroethene. The previous IRIS ratings are therefore provided above (EPA, 1991b). The Science Advisory Board of EPA (1992c) considers the WOEs of perchloroethylene and trichloroethene to be on a B2−C continum; to date, however, no final WOE has been provided by EPA.

Table 11. Preliminary List of Possible Human Receptors and Complete Exposure Pathways
Risk Assessment Work Plan
Preliminary Study Area
Boise, Idaho

Exposure Pathways	AREA 1			AREA 2	AREA 3 /a/	AREA 4	
	Construction/ Maintenance Workers	Mall Workers	Shoppers (Children and Adults)	Commercial Workers	Residents (Children and Adults)	Commercial Workers	Residents (Children and Adults)
Inhalation of vapors indoor	X	X	X	X	X	X	X
Inhalation of vapors outdoor	X	X	X	X	X	X	X
Ingestion of soil	X	--	--	--	--	--	--
Dermal contact with soil	X	--	--	--	--	--	--
Ingestion of groundwater as drinking water	--	--	--	X	X	X	X
Inhalation of vapors from groundwater during showering	--	--	--	X	X	X	X
Dermal contact with groundwater during showering	--	--	--	X	X	X	X

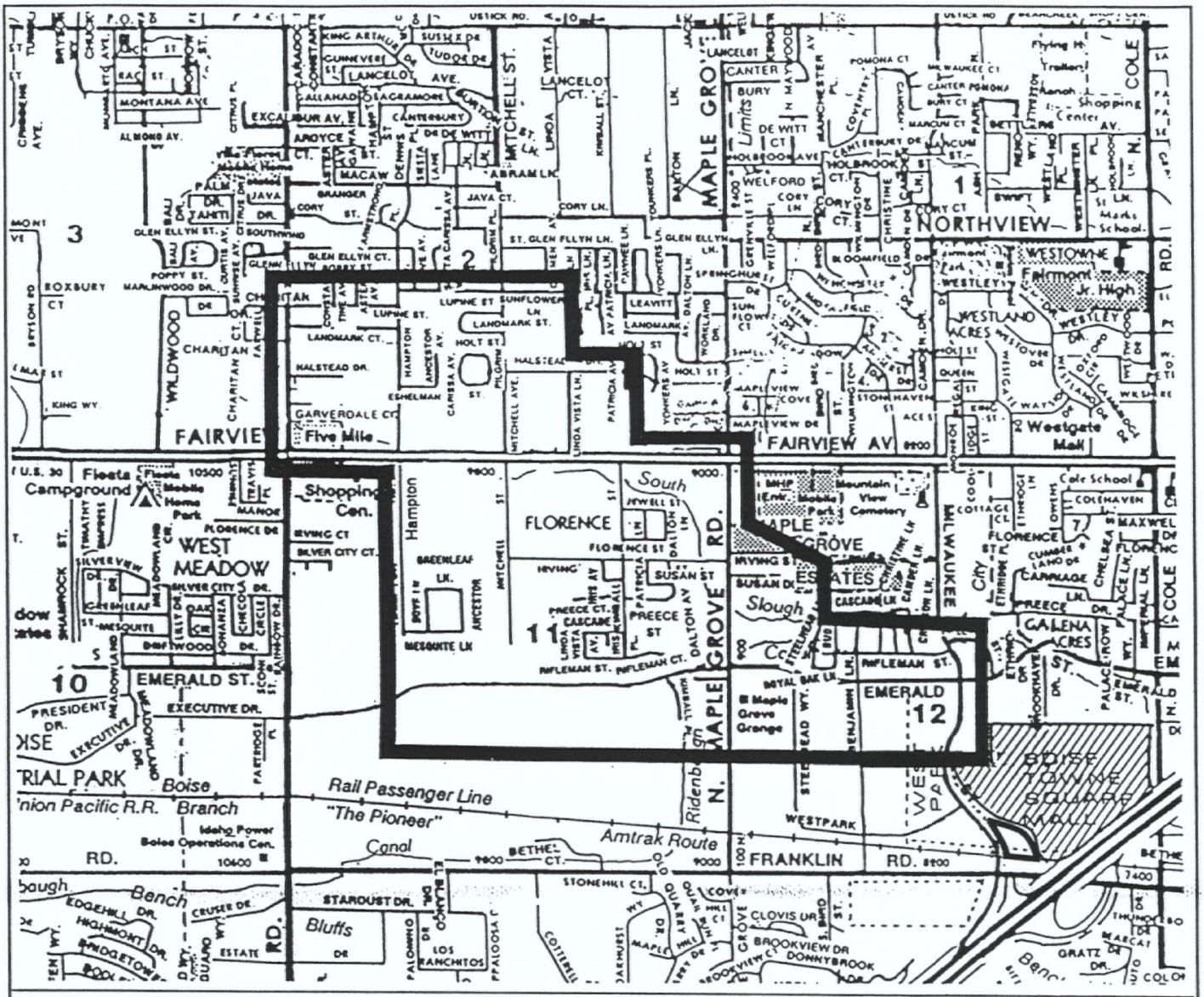
X = Pathway to be considered in the risk assessment.
-- = Incomplete pathway, not to be considered in the risk assessment.
/a/ Commercial workers not considered, since majority of Area 3 is residential.

Table 12. Water Solubilities, Vapor Pressures, and Henry's Law Constants for Chemicals of Potential Concern
Risk Assessment Work Plan
Preliminary Study Area
Boise, Idaho

Chemicals of Potential Concern	Water Solubility (mg/l) /a/	Vapor Pressure (mm Hg) /b/	Henry's Law Constant (atm−m^3/mol) /c/
1,2−Dichloroethene (total)	NA /d/	NA	NA
Tetrachloroethene	150	18	0.026
Trichloroethene	1100	58	0.009

/a/ Milligrams per liter.
/b/ Millimeters of mercury.
/c/ Atmospheres − cubic meter per mole.
/d/ NA = Not available.
Source: EPA, 1986b.

PLATES



REFERENCE: Boise Metro Map, Published by Hunt Enterprises, Boise

EXPLANATION

Mall Investigation Area

Preliminary Study Area

0 1/2 1

SCALE IN MILES

N

Harding Lawson Associates
Engineering and Environmental Services

Mall and Preliminary Study Area
PSA Risk Assessment Work Plan
Boise, Idaho

PLATE **1**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
pg	20783 0081	SR	11/92	

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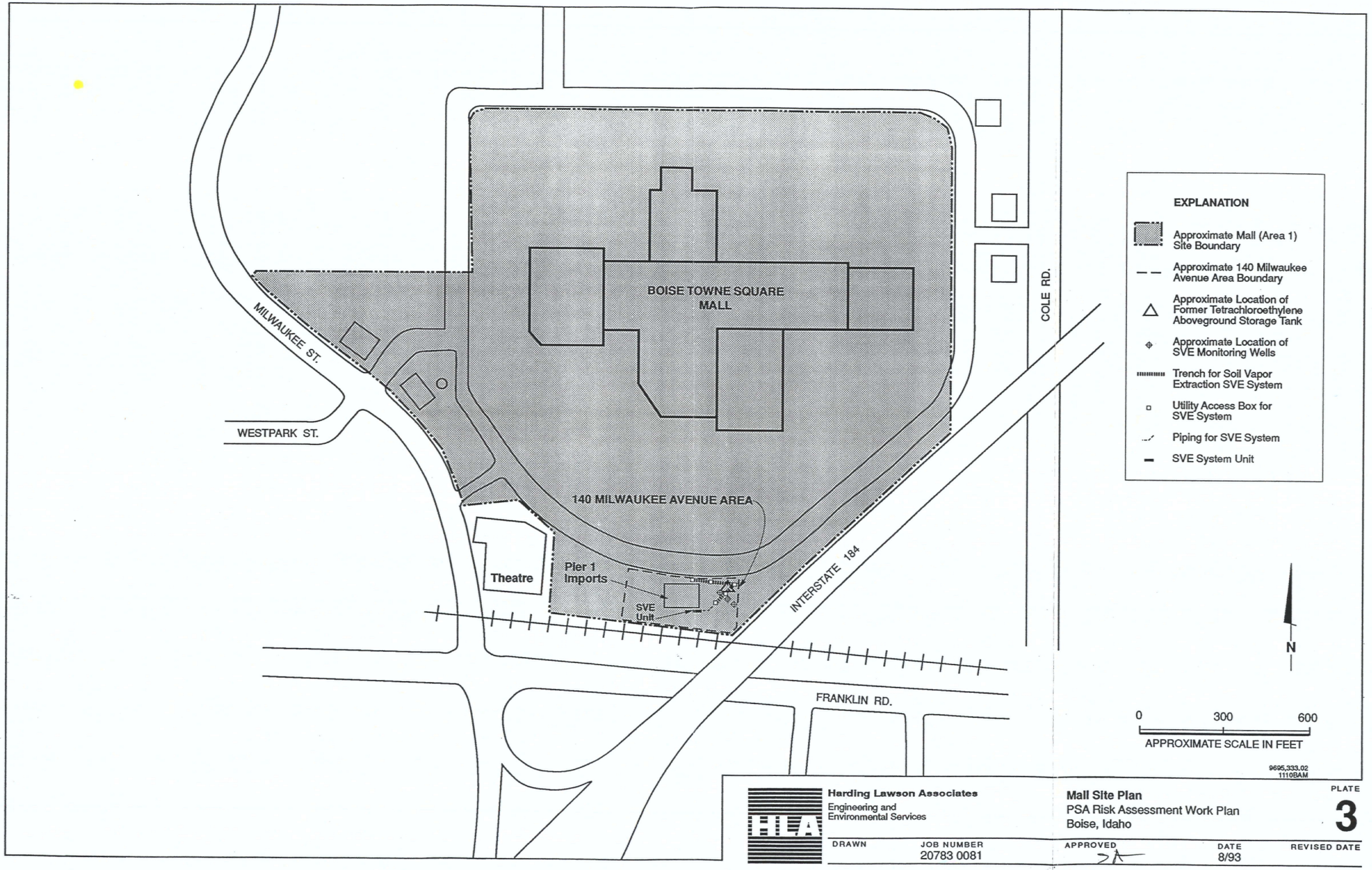

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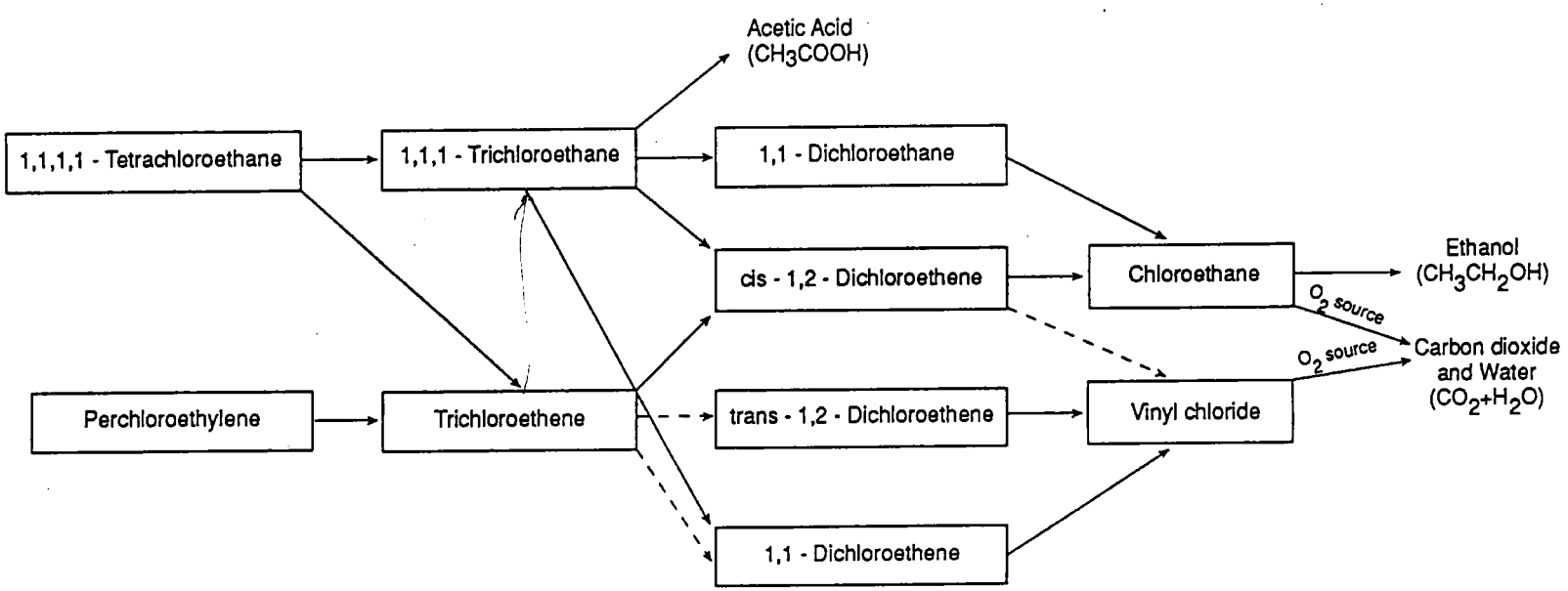
Harding Lawson Associates
Engineering and Environmental Services

Mall Site Plan
PSA Risk Assessment Work Plan
Boise, Idaho

PLATE **3**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
	20783 0081		8/93	



LEGEND

PRIMARY PATHWAY

SECONDARY PATHWAY

NOTES: 1) CIS-1,2-DICHLOROETHENE GENERATED AT APPROXIMATELY 30 TIMES THE CONCENTRATION OF TRANS-1,2-DICHLOROETHENE.

From: Olsen, R.L., and A. Davis, 1990

Transformation of Chlorinated Ethenes and Ethanes

PSA Risk Assessment Work Plan

Boise, Idaho

PLATE 4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PMc	20783 0081		8/93	

Harding Lawson Associates

Engineering and Environmental Services

APPENDIX

STATE OF IDAHO DEPARTMENT OF HEALTH

AND WELFARE

PROJECT FACT SHEETS

IDAHO DEPARTMENT
OF HEALTH AND WELFARE

DIVISION OF
ENVIRONMENTAL QUALITY

1420 North Hilton, Boise, Idaho 83706-1260, (208) 334-0550 Cecil D. Andrus, Governor Richard P. Donovan, Director

January 3, 1992

John Doe
Anyplace
Anytown

Dear Sir:

Your help is needed in assessing the extent of a ground water problem. The Department of Health and Welfare, Division of Environmental Quality, has sampled some wells in the area northwest of the Boise Towne Square mall. Nine of 23 private wells tested showed elevated concentrations of the chemical tetrachloroethylene. More testing is needed to determine where the chemical -- also called Perc -- may be present. Perc is a common industrial solvent frequently used for dry cleaning and high-quality metals cleaning. If you do not have a well, you are not being exposed to the Perc.

The state needs your help to identify all wells in and around the area where Perc is suspected. **If you have a well that is used for any purpose, please call the Division at 334-0456 by January 10.** The telephone hotline for this project will be staffed Monday through Friday, 8 a.m. to 5 p.m. At other times you may leave a recorded message and we will return your call. Staff from the Division will be going door-to-door in January to help make sure we have identified all the wells and to gather additional information about them. At that time, we may ask for permission to sample your well.

A public meeting to answer your questions is set for 7 p.m., Monday, Jan. 13, at the Division of Environmental Quality, 1410 N. Hilton. Don't hesitate to call the hotline, 334-0456, if you have questions before the meeting.

Given our present understanding of Perc, and the concentrations we are finding in West Boise, the short term health risks are minimal. The primary health concern at the concentrations we are finding in West Boise is an increased long-term risk of liver cancer. Drinking water well tests in West Boise have shown concentrations of less than one to 200 parts per billion.

The Division has asked businesses that may be responsible for Perc entering the area's ground water to provide clean water supplies to owners and users of wells that are contaminated or threatened. One of these companies, Van Waters and Rogers Inc. (VW&R), will voluntarily work with the state to bring public water lines to affected homes at no cost to the owners.

The first step in this project is to carefully determine which wells may be affected. In cooperation with the Division, VW&R will sample wells on the edge of the area where previous tests have shown Perc. Once we define borders of the area where Perc is present, VW&R will offer public water supply hookups to all current well users in that area. The water hookups will be provided at no cost to the well owners. The state will be working to identify any additional sources of contamination and will work with all responsible parties to perform the necessary investigation and cleanup.

Sincerely,

Larry Koenig
Administrator, Southwest Idaho Regional Office

VAN WATERS & ROGERS INC.
WEST BOISE PERC HOTLINE QUESTIONS & ANSWERS
JANUARY 3, 1992

1. Why is Van Waters & Rogers Inc. willing to provide alternative water supplies at this time?

Van Waters & Rogers agrees with the State that there are potentially multiple sources contributing to the presence of Perc in groundwater. However, it may take some time to identify those other sources and to ensure their participation. We feel it is appropriate to take action now to alleviate any questions about the future use of the groundwater from private wells. Accordingly, Van Waters & Rogers has taken the lead and voluntarily proposed a plan to provide alternative water to the residents of West Boise with affected wells downgradient of the Boise Towne Square Mall. Van Waters & Rogers will continue to cooperate with the State and to work closely with the community until the situation is responsibly resolved.

2. Have other parties contributed to this situation?

The results of sampling and investigation activities performed by Van Waters & Rogers and others indicate the potential for other sources of Perc. There is not enough information at this time to identify other specific sources by name.

3. Is there a correlation between the Perc identified in groundwater downgradient from the Boise Towne Square Mall and the Garden City Area?

No. We agree with the State that there is no connection between Van Waters & Rogers and the Garden City groundwater problem. The former VW&R facility is located some distance from the Garden City Area and there are clean wells between these locations.

4. How many people are using water from wells in the area?

At this time, neither the State nor Van Waters & Rogers knows the specific number of people who use water supplied from affected wells. One of the steps of our proposed plan is to support a door to door survey conducted by the State to identify who is receiving well water.

5. Will bottled water be supplied until the water hookups can be completed?

Given our present understanding of Perc in West Boise groundwater and the concentrations that have been found, the short term risks to groundwater users are minimal. Accordingly, there are no current plans to provide bottled water. Van Waters & Rogers will be working cooperatively and expeditiously with the State to provide a permanent source of alternative water to the residents of West Boise with affected wells downgradient of the Boise Towne Square Mall. We have already identified areas where water hookups to the Boise Water Corporation system can begin within the next few months.

6. Who will pay for the cost of the water hookups?

Van Waters & Rogers will pay for all the reasonable costs for supplying a hookup to the Boise Water Corporation for the residents of West Boise with affected wells downgradient of the Boise Towne Square Mall. In addition, the first year of water utility bills will be paid by Van Waters & Rogers.

7. Will Van Waters & Rogers test my well for me?

Van Waters & Rogers will be working with the State to identify the total area with wells affected by Perc downgradient of the Boise Towne Square Mall. After a door to door survey has been conducted to identify all the wells in the area, selected wells within this area will be sampled and analyzed by Van Waters & Rogers. It is too early to identify which specific wells will be sampled.

For further information please contact Wayne Grotheer at 206/889-3470 or Gail Clement at 602/272-3272.

State of Idaho
DEPARTMENT OF HEALTH AND WELFARE
Office of the Director

CECIL D. ANDRUS
Governor
RICHARD P. DONOVAN
Director

450 W. State Street
Statehouse Mail
Boise, Idaho 83720-5450
(208) 334-5500

FACT SHEET
TETRACHLOROETHYLENE (Perc)

What is Perc?
Perc is a term used for tetrachloroethylene, a synthetic chemical also know as perchloroethylene, PCE or 1, 1, 2, 2, tetrachloroethene. The chemical is called "Perc" because the names are long and difficult to pronounce. It is a solvent used for dry cleaning and removing grease from metal.

How can I tell if it is in my water supply?
Generally, there is no smell or taste when low levels of Perc are present in water. However, a sharp, sweet odor is evident when Perc is present in very high concentrations. The only way to determine if Perc is present in your water is to submit a sample to a professional testing laboratory. Labs in Idaho that test for Perc and other volatile organic compounds include Alchem Laboratory of Garden City, 336-1172, and Hibbs Analytical Laboratories of Boise, 342-5515. The Idaho Department of Health and Welfare, Bureau of Laboratories in Boise, 334-2235, also performs these tests. The cost for a lab test is about $200. To ensure accurate results you will need professional sampling and analysis.

How do people get exposed to Perc?
People can be exposed to Perc either by drinking water or breathing air that has been contaminated. Some household cleaners, spot removers, water repellants and lubricants also may contain Perc.

What health effects should I be concerned about?
Because Perc evaporates from water and can be inhaled, health officials discourage use of contaminated well water indoors for any purpose. Inhaling extremely high concentrations of Perc in industrial or work settings can affect the nervous system and lead to symptoms like dizziness and headaches.

The U.S. Environmental Protection Agency has proposed a maximum allowable level of five parts per billion in drinking water. The hazard from exposure to Perc in drinking water is a long-term cancer risk. Health statisticians calculate the increased lifetime risk of developing cancer of the liver is one in 10,000 for people who each day drink a half gallon of water containing more than 100 parts per billion of Perc.

What happens to Perc in the body? Should I see my doctor if I've been exposed?
Perc is eliminated from the body rather rapidly. It does not build up. Health officials do not recommend a visit to a doctor for healthy adults. However, you may want to discuss Perc exposure with your doctor if you are being evaluated for liver disease or if you are pregnant.

Should I buy a filter to remove Perc?
Water quality experts do not recommend home treatment systems because it is difficult to ensure they will work and they are difficult to maintain.

Will Perc evaporate or decompose?
Perc is very mobile in soil and readily migrates to ground water, where it may remain for months or years. It will slowly evaporate from surface water and break down within a few weeks when released to the air.

Can I water my garden or give well water to animals?
Animals face an increased cancer risk from exposure to Perc. It is safe to water your garden with water contaminated with Perc. However, because Perc evaporates and can be inhaled, watering should be done outdoors or in a well-ventilated space.

Should I bathe in water containing Perc?
Health officials advise against using water containing Perc for any purpose indoors. Perc absorption through the skin is not a problem, but breathing the Perc that evaporates from the water creates increased health risks.

Where can I get more information?
For information about health issues, contact the Division of Health, Boise, 334-6584. For information on environmental issues, contact the Division of Environmental Quality, Boise, 334-5860, or regional offices in Coeur d'Alene, Lewiston, Boise, Twin Falls and Pocatello.

West Boise Perc Contamination
Common Questions and Answers
Perc Hotline

1. What is Perc? Can I taste it? Smell it? Will I know if my water is contaminated?
Perc, also known as tetrachloroethylene or perchloroethylene, is a common industrial solvent used for dry cleaning and high-quality metals cleaning. At low concentrations you will not be able to taste it or smell it in your water. A sample from a well must be analyzed in a laboratory to determine if Perc is present and at what concentration.

2. Is it under my house?
That depends on where you live. The Department of Health and Welfare, Division of Environmental Quality, took ground water samples last year in an area northwest of the Boise Towne Square mall roughly to the intersection of Maple Grove and Fairview avenues. We found Perc at levels exceeding the federal drinking water standard in 9 of 23 wells sampled. We have not yet determined the complete area affected by Perc. Van Waters and Rogers Inc. (VW&R) will work cooperatively with the Division to take samples and determine the affected area.

3. How did it get there? Where did it come from?
We are not sure of all the sources. One source appears to be VW&R. From 1973 until 1983, VW&R operated a chemical distribution facility with a Perc storage tank which was located just east of the site now occupied by the Pier 1 Imports store near the corner of Cole and Franklin roads. Sampling by VW&R last summer and fall identified Perc in the ground at the location of its former facility. No definite link has been established between the former VW&R facility and the affected private wells. We will be conducting further investigations to find out if there are other sources.

4. Can I drink my tap water?
If you are hooked up to Boise Water Corp. your water is not affected. You may drink it without concern. The proposed federal drinking water standard for Perc is five parts per billion. If Perc in your well water is higher than the federal standard, you should hook up to Boise Water. VW&R has agreed to pay for these hookups. We have a map of the affected area and can help you determine if your well is located in the area of concern.

5. If I'm not sure if I'm on a well, how do I find out?
If you get your water from Boise Water Corp. you are not on a private well and your water supply is not affected. If you get your water from another source, you should check with the property owner to determine if a well is used.

6. What health effects should I be concerned about?
Given our present understanding of Perc, and the concentrations we are finding in West Boise, the short term health risks are minimal. The primary health concern at these concentrations is an increased long-term risk of liver cancer. Drinking water well tests in West Boise have shown concentrations of less than one to 200 parts per billion.

Perc is eliminated from the body rather rapidly. It does not build up. Health officials do not recommend a visit to a doctor for healthy adults. However, you the area northwest of the mall we have found levels of less than one to 200 parts per billion of Perc in the water. The federal drinking water standard is five parts per billion.

You may want to discuss Perc exposure with your doctor if you are being evaluated for liver disease or if you are pregnant.

7. How much Perc is in the water?
In the area northwest of the mall we have found levels of less than one to 200 parts per billion of Perc in the water. The federal drinking water standard is five parts per billion.

8. Will I be exposed to Perc if I go to the mall?
No. The Perc has been found several feet below the ground beneath the paved parking lots at the southeast end of the mall. The contamination is not in the air. The water at the mall is supplied by Boise Water Corp. and is not affected.

9. Should I buy a filter to remove Perc?
Water quality experts do not recommend home treatment systems because it is difficult to ensure they will work and they are difficult to maintain.

10. I live in another area where Perc has been found. Why aren't you doing this for me?
The state is working with all potentially responsible parties that it can identify wherever chemicals are found in ground water. The goal in all cases is to move as quickly as possible to identify the source of the chemical, protect public health and clean up contamination.

11. What is being done?
VW&R and the state will be working together this winter to determine borders of the area where Perc is in ground water. Anyone living in that area and using water from a well will be offered a free hookup to Boise Water Corp.'s public water supply. It will take a few months to finish all the hookups, with costs covered by VW&R.

Since 1990, a ground water treatment system has been operating in an area near the intersection of Benjamin Lane and Emerald Street. This system already has treated about 190 million gallons of ground water containing Perc. The Division will be working to identify any additional sources and will work with all responsible parties to perform the necessary investigation and cleanup.

12. Can I test my water? How? How much does it cost?
VW&R will be testing selected wells to identify borders of the area where Perc is located. A private lab can test your water. It will cost about $200 to have your water tested for Perc. To ensure accurate results you will need professional sampling and analysis. Some of the labs that perform water tests are: Alchem Laboratory of Garden City, 336-1172; Hibbs Analytical Laboratories of Boise, 342-5515; and the Idaho Department of Health and Welfare, Bureau of Laboratories in Boise, 334-2235.

13. Who do I call with questions?
If you have any questions you can call the West Boise hotline, 334-0456. Staff will be available to answer questions during business hours. After business hours, you can leave your name and number on a recorded message, and we will call you back.

All health related questions should be referred to:

State Toxicologist	Pat McGavern	334-6584

Contacts for other projects:

Garden City	Craig Shepard	334-0550
Downtown	Craig Shepard	334-0550
Capitol Station	Craig Shepard	334-0550
Other	By regional office	

Pier 1 Imports	Rob Lawrence	817-878-8000
Towne Square Mall	Mall office	378-4400
Van Waters and Rogers	Wayne Grotheer	206-889-3470
	Gail Clement	602-272-3272

IDAHO DEPARTMENT OF HEALTH AND WELFARE
DIVISION OF ENVIRONMENTAL QUALITY

1410 North Hilton, Statehouse Mail, Boise, ID 83720-9000, (208) 334-0502 Cecil D. Andrus, Governor Richard P. Donovan, Director

West Boise Perc Contamination
Project Fact Sheet

What is the problem?
The Department of Health and Welfare, Division of Environmental Quality, has identified tetrachloroethylene, also known as perchloroethylene or Perc in private wells in an area northwest of the Boise Towne Square mall. Perc was found in some drinking water wells in concentrations ranging from less than one to 200 parts per billion. The federal drinking water standard is five parts per billion.

What is Perc?
Perc is a common industrial solvent frequently used for dry cleaning and high-quality metals cleaning. At concentrations found in ground water in West Boise (or less than 200 parts per billion), you will not be able to taste it or smell it in your water. A sample from a well must be analyzed in a laboratory to determine if Perc is present.

Where is the contamination?
We don't know the complete answer at this time. However, we have sampled private wells from about the intersection of Emerald Street and Milwaukee Avenue to the corner of Fairview and Maple Grove avenues. Of 23 wells sampled in this area, nine had concentrations of Perc that exceed the drinking water standard. Van Waters and Rogers Inc. (VW&R), in cooperation with the state, will be taking samples this winter to determine borders of the area where Perc is present.

Where did it come from?
We don't know the complete answer at this time. One source appears to be VW&R. From 1973 until 1983 VW&R operated a chemical distribution facility with a Perc storage tank which was located just east of the site now occupied by the Pier 1 Imports store near the corner of Franklin and Cole roads. Last summer and fall VW&R sampled that area and found Perc in the ground. No definite link has been established between the former VW&R site and the affected private wells. We will be conducting further investigations to find out if there are other possible sources of the Perc.

What are health risks from drinking water containing Perc at these concentrations?
Given our present understanding of Perc, and the concentrations we are finding in West Boise, the short term health risks are minimal. The primary health concern at these concentrations is an increased long-term risk of liver cancer. Drinking water well tests in West Boise have shown concentrations of less than one to 200 parts per billion.

How much Perc is in the water?
In the area northwest of the mall, we have found from less than one to 200 parts per billion of Perc in the ground water. Concentrations in the area where the VW&R tank was located are closer to 5,000 parts per billion in ground water beneath a paved parking area, however there are no drinking water wells at that spot.

Should I buy a filter to remove Perc?
Water quality experts do not recommend home treatment systems because it is difficult to ensure they will work and they are difficult to maintain.

What is being done?
VW&R and the state will be working together this winter to determine borders of the area where Perc is found in ground water. Anyone living in the affected area -- and using water from a well -- will be offered a free hookup to Boise Water Corp.'s public water lines. It will take a few months to get all the hookups in place. VW&R will pay for water hookups.

Since 1990, a ground water treatment system has been operating in an area near the intersection of Benjamin Lane and Emerald Street. This system has already treated about 190 million gallons of ground water containing Perc. The state will be working to identify any additional sources and will work with all responsible parties to perform the necessary investigation and cleanup.

Who can answer additional questions?
Residents and property owners may call a hotline dedicated to the West Boise project, 334-0456. Staff will be available during business hours, Monday through Friday. If you would like to call during the evening, leave a message and we will call you back.

DISTRIBUTION

Risk Assessment Work Plan
Preliminary Study Area
Boise, Idaho

December 28, 1993

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